

WHAT IS CLAIMED IS:

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1. A backflow preventor apparatus for connection to parallel, oppositely-flowing inlet and outlet conduits, comprising:

5 a housing configured to accommodate first and second valves, and to receive fluid flow from said inlet conduit flowing in a first direction;

10 a first valve mounted in said housing having a first clapper movable between an open configuration permitting flow through said first valve and a closed configuration preventing flow;

15 a second valve mounted in said housing having a clapper movable between an open configuration permitting flow through said second valve and a closed configuration preventing flow;

20 said first valve clapper, when in said open configuration, being positioned to direct said flow from said first direction to provide flow in a second direction towards said second valve;

25 said second valve clapper, when in said open configuration, being positioned to direct said flow from said second direction to a third direction towards said outlet conduit.

2. Apparatus, as claimed in claim 1, further comprising:

P/ 30 at least a first shutoff valve connected to said housing, operable by a handle extending substantially horizontally outward from said housing in a direction substantially perpendicular to a line passing through said inlet and outlet conduits.

35 3. Apparatus, as claimed in claim 1, further comprising:

P/ at least a first shutoff valve connected to said housing, operable by a handle which, during opening and closing of said shutoff valve, moves substantially horizontally outward

from said housing in a direction substantially perpendicular to a line passing through said inlet and outlet conduits.

4. Apparatus, as claimed in claim 2, further comprising:

a second shutoff valve positioned between said housing and one of said inlet and outlet conduits.

5. Apparatus, as claimed in claim 1, further comprising:

first and second openings in said housing, said first opening providing access to said first valve and said second opening providing access to said second valve, one of said first and second openings lying in a substantially horizontal plane, the other of said openings lying in a substantially vertical plane; and

first and second removable coverings for said openings.

6. Apparatus, as claimed in claim 1, wherein said housing includes a valve body having at least first and second ports, one of said ports being an inlet port and the other of said ports being an outlet port, and wherein at least one of said first and second valves includes:

a valve seat adjacent to said first port;

a clapper configured to sealingly mate with said valve seat, said clapper pivotally attached adjacent to said valve seat to pivot about a first axis between a first position, wherein said clapper sealingly mates with said valve seat and at least a second position spaced from said valve seat;

first means for biasing said clapper in a direction toward said first position, said means for biasing having a first end and a second end, and forming a compressible connection between said clapper in said first position and said valve body;

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P1
P1
second means, adjacent said first end, for attaching said means for biasing to said valve body at an attachment point; and

5 third means, adjacent said second end, for pivotally attaching said means for biasing to said clapper to permit pivoting of said means for biasing with respect to said clapper about a second axis, wherein the position of said second axis, with respect to said clapper and with respect to said second end, remains fixed during movement of said clapper
10 from said first position to second position.

7. Apparatus, as claimed in claim 1, wherein said housing includes a valve body having at least an inlet port and an outlet port, and wherein at least one of said first and
15 second valves includes:

P1
P1
an annular valve seat adjacent to said inlet port;

a disk-shaped clapper configured to sealingly mate with said annular valve seat;

P1²⁰
an arm rigidly attached to said clapper having a first end and a second end, said first end being pivotally attached adjacent to said inlet port to permit pivoting of said clapper about a first axis from a first position sealingly mating with said valve seat to a second position spaced from
25 said valve seat to permit fluid flow through said inlet port; and

P1
a helical compression spring having first and second spring ends, said first spring end pivotally attached to said valve body to permit pivoting of said spring about a
30 second axis, said second spring end directly pivotally attached to said second end of said arm, to permit pivoting of said spring with respect to a third axis said spring producing a force along a first longitudinal spring axis definable with respect to said first spring end and said second spring end,
35 said force having a closing component which biases said clapper to move in a direction toward said first position, said force being direct along a line passing through said second axis and said third axis substantially without a lateral force component

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in any clapper position, said closing component being greater when said clapper is in said first position than when said clapper is in said second position.

5 8.1 Apparatus, as claimed in claim 1, wherein said first valve, when in said closed configuration, is adjacent a valve seat, said valve seat positioned at a first level, and wherein said housing includes:

10 a conduit connecting said first and second valves, said conduit having at least a first portion sloping downward to provide a region at a level below the level of said valve seat of said first valve.

8.2 Apparatus, as claimed in claim 1, further
15 comprising a relief valve connected to said housing by at least a first conduit, said first conduit providing fluid communication with a first region of said housing upstream of said first valve and connected to said housing to provide fluid communication with a second region of said housing downstream
20 of said first valve.

Sub 3
10. A backflow preventor apparatus for connection to parallel, oppositely-flowing inlet and outlet conduits, comprising:

25 a housing configured to accommodate first and second valves, and to receive fluid flow from said inlet conduit flowing in a first direction;

30 a first valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration permitting flow in the absence of substantial divergent flow around the edge of said first valve disc;

35 a second valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration permitting flow in the absence of substantial diverging flow around the edge of said second valve disc;

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said fluid flow having an average streamline path between said inlet conduit and said outlet conduit.

11. Apparatus, as claimed in claim 10, wherein the sum of changes in flow direction of said average streamline path is not substantially greater than about 180 degrees.

Substant
12. A backflow preventor apparatus for connection to parallel, oppositely-flowing inlet and outlet conduits, comprising:

a housing configured to accommodate first and second valves, and to receive fluid flow from said inlet conduit flowing in a first direction;

a first valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration permitting flow in the absence of substantial divergent flow around the edge of said first valve disc;

a second valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration permitting flow in the absence of substantial diverging flow around the edge of said second valve disc;

said fluid flow having an average streamline path between said inlet conduit and said outlet conduit wherein the sum of changes in flow direction of said average streamline path is not substantially greater than about 180 degrees;

said first valve disc, when in said open configuration, being positioned to direct said flow from said first direction to provide flow in a second direction towards said second valve;

said second valve disc, when in said open configuration, being positioned to direct said flow from said second direction to a third direction towards said outlet conduit.

13. A backflow preventor apparatus for connection to parallel, oppositely-flowing inlet and outlet conduits, comprising:

5 a housing configured to accommodate first and second valves, and to receive fluid flow from said inlet conduit;

a first valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration permitting flow through an inlet port in a first direction, 10 said first valve mounted to extend along an axis defined by said first direction;

a second valve mounted in said housing having a seatable valve disc having an edge, movable between a closed configuration preventing flow and an open configuration 15 permitting flow through an inlet port in a second direction, said second valve mounted to extend along an axis defined by said second direction, said axis of mounting of said second valve being substantially perpendicular to said axis of mounting of said first valve;

20 said fluid flow having an average streamline path between said inlet conduit and said outlet conduit, wherein the sum of changes in flow direction of said average streamline path is not substantially greater than about 180 degrees.

25 14. A method for preventing backflow between parallel, oppositely-flowing inlet and outlet conduits, comprising:

30 providing a housing configured to accommodate first and second valves, and to receive fluid flow from said inlet conduit flowing in a first direction;

mounting a first valve in said housing, said first valve having a first clapper movable between an open configuration permitting flow through said first valve and a closed configuration preventing flow;

35 mounting a second valve in said housing, said second valve having a clapper movable between an open configuration permitting flow through said second valve and a closed configuration preventing flow;

attaching said housing to said inlet and outlet conduits;

directing said flow from said first direction to provide flow in a second direction towards said second valve, using said first valve clapper, when in said open configuration; and

directing said flow from said second direction to a third direction towards said outlet conduit, using said second valve clapper, when in said open configuration.